Current Density and Electrode Structure
A Qualitative Survey

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Abstract*

The effect of electrode structure on the current density obtainable in a fuel cell is second only to that of the electrocatalysts. The structure and the functioning of such electrodes are so complex that the quantitative treatment of simple models can scarcely be expected to do more than suggest further experiments. In this situation, a qualitative appraisal of the relationship between electrode structure and current density seems in order.

The qualitative appraisal we have made leads to these conclusions, most of which are based on work by others:

1. A working fuel cell electrode owes much of its effectiveness to thin electrolyte films through which the reacting gases diffuse.

2. These films are so thin that they can change rapidly in thickness and extent: a working fuel cell electrode is a dynamic system.

3. The oversimplified idea that electrode reaction occurs mainly at the 3-phase boundary should be abandoned.

4. The increased importance of gas diffusion through thin electrolyte films makes the name "gas diffusion electrode" even more ambiguous. Redefinition is in order.

5. Under the simplest conditions (e.g. pure hydrogen at an anode), thin electrodes are likely to perform in fuel cells at least as well as thick; and they seem preferable when conditions are more complex.

6. A good electrode structure should give almost as good performance on air as on oxygen over a large range of current densities.

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